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PERONOSPOREÆ AND RAIN-FALL.

By Byron D. Halsted.

The chief point in this paper is to contrast the prevalence of the *Peronosporeæ* during the past year with the quite general absence of them the two previous years. It will be necessary to state the leading difference in the rain-fall of the last two years, and as this is the only apparent element of variation, except in so far as this modifies other meteorological conditions, it is only natural to attribute the variations in amount of mildew largely to the difference in the rain-fall.

The year 1887 was an exceedingly dry one and the last growing season has been not far from the average one in moisture. In 1887, according to the weather record kept at the college (Ames, Iowa) and kindly furnished me by Professor Osborn, the showers in time and amount were as follows:

	Inches.		Inches.
Mar. 5	.10	July 17	.02
Mar. 27	.56	July 18	.30
Apr. 23	1.26	July 19	1.45
Apr. 26	.02	July 22	.13
May 14	.16	July 30	.41
May 22	.08	Aug. 5	.23
May 29	.15	Aug. 9	.11
June 6	.02	Aug. 10	.08
June 11	.20	Aug. 18	.09
June 12	.43	Aug. 20	.40
June 13	1.16	Aug. 21	.08
June 20	.23	Aug. 26	.10
July 13	.45	Aug. 30	.08
July 16	.02		

By month this gives for—

	Inches.		Inches.
March	.66	June	2.04
April	1.28	July	2.78
May	1.39	August	1.17

This is an average of only 1.39 inches per month and a total of 8.32 for that half of the year when rain is most essential for the existence and growth of vegetation. This prolonged drought was made more intense by the preceding dry year. It was in fact the second of two comparatively rainless seasons. September opened with refreshing showers, and by the close of the month the rain-fall amounted to nearly 10 inches (9.77).

For six months in 1888 the rainy days were as given below:

	Inches.		Inches.
Apr. 26–29	1.22	July 4–5	1.86
May 3-4	1.51	July 16	1.73
May 7–9	1.47	July, scattering (3)	.58
May 27–28	1.11	Aug. 5–6	.37
May, scattering (3)	.46	Aug. 10	.65
June 1	.38	Aug. 14–15	1.38
June 12	.17	Aug. 28	.14
June 20–21	1.19	Sept., scattering (4)	.16
June 27	.66		

By month this gives for—

	Inch.		Inch.
April	1.22	August	2.54
May	4.55	September	.16
June	2.40	Total	15.04
July	4.17		

It will be noticed that while in 1887 there were only three rains of over an inch in the growing season, during the past year the record shows seven. The most marked difference was in May, when 4.55 inches of 1888 stands in contrast with 1.39 inches of 1887. It should be kept in mind that May is the time when rains, if not in excess, do the greatest amount of good, as vegetation then is in a condition to profit most from showers. The amount in June remains about the same, but that for July and August is nearly double. The species of *Peronosporeæ* are taken up one by one, as this seems the best method of exhibiting the contrasts.

PHYTOPHTHORA INFESTANS, DBY. Three years ago, after an average season, there was much complaint of the rot in all parts of Iowa, and housed tubers contained the parasite in abundance. The potato crop for 1888 was very heavy, and no rot has been seen by or reported to me. The two very dry years, viz, 1886 and 1887, doubtless have greatly reduced the number and vitality of the rot spores, and done more than an average season to rapidly develop the rot.

PERONOSPORA VITICOLA, DBY. None of this mildew of the grape was found last year, although the search for it was frequently made, and in places where two years before the wild canes of *Vitis riparia*, were dwarfed and covered with a thick white felt down to the earth's surface. No signs of the mildew could be found in the large college vineyard, where many sorts of cultivated grapes and a few scattered vines of native wild species are grown. The vines were in every way healthy, and flourished when all vegetation about them was suffering with drought and heat. This season the cultivated vines suffered severely from the mildew, and nearly every leaf was more or less affected and the crop much injured.

PERONOSPORA HALSTEDII, FARLOW, is the most wide-spread species in Iowa. Its hosts are numerous, the leading ones of which are several species of *Helianthus*, *Silphium*, *Eupatorium*, *Bidens*, and a long list of other genera all of the order *Compositæ*. In 1886 this mildew was moderately common, but last year it was found only upon those composites which were in wet places. It was rare upon *Helianthus;* not found at all upon *Ambrosia artemisiæfolia*, *Solidago Canadensis*, or *Eupatorium* and *Silphium* species. In short, the genus *Bidens* was the only one which could furnish any considerable supply of specimens. *B. frondosa*, *B. chrysanthemoides*, and *B. connata*, var. *comosa*, all were infested, but these hosts grew in beds of streams where plenty of moisture reached the rank succulent plants. This year there has been a fair quantity of the *Compositæ* mildew upon the high-ground plants, especially about the middle of June, which may be accounted for by the May rains.

PERONOSPORA OBDUCENS, SCHRŒT, upon *Impatiens fulva*, has not been met with during the last three years. It is not a common species in the most favorable season.

PERONOSPORA GERANII, PK., was not found last year upon the common host *Geranium maculatum*, but in May was collected by A. S. Hitchcock upon *Geranium Carolinianum*, at Iowa City. During June of 1888 the mildew was very abundant upon *G. maculatum;* in fact, more so than any other species at that time.

In May last a *Peronospora* was found upon the common water leaf (*Hydrophyllum Virginicum*). I am not aware that Dr. Farlow, to whom specimens were sent, has determined the species. It was growing over the same areas, and closely associated with the Spotted Cranesbill affected with *P. geranii.* It is very interesting to note that the same species was first discovered by Mr. Holway about a fortnight earlier, at Decorah, Iowa, and also found by Mr. Hitchcock, of Iowa City, at almost the same time as at Ames.

PERONOSPORA PYGMÆA, UNGER, on *Anemone* sp., was not observed last year, but in 1888 it flourished in late May and early June.

PERONOSPORA GANGLIFORMIS, DBY., occasionally appeared upon the lower leaves of *Mulgedium leucophœum*, in 1887. The other hosts prefer dry ground, and in their dwarfed condition were not infested. During the year just closed it could be said to be common upon *Prenanthus* and *Lactuca* hosts.

PERONOSPORA PARASITICA, TUL., is one of the most common species upon various cruciferous hosts. In ordinary seasons *Lepidium Virginicum*, is badly infested, having its branches strangely distorted. Last year the pepper-grass was quite free from the parasite, if we except the seedlings, which were attacked for a few weeks in spring. The *Peronospora* was most abundant upon *Nasturtium palustre.* In June the lower leaves of the host, lying close to the moist ground of borders of streams, were quite generally affected. A little later, when the drought had progressed, it was not abundant. In some specimens the conidiophores were not more than one-fourth the normal size. Early in 1888 the mildew was abundant upon the pepper-grass, and continued so until July.

PERONOSPORA POTENTILLÆ, DBY., was common on *Potentilla Norvegica*, early in 1887, when the host was growing on the borders of low wet places. It disappeared as the dry weather of late spring arrived. Last season it did not appear in abundance until July, when whole large plants were found attacked.

PERONOSPORA ARTHURI, FARLOW, was not common three years ago, but during 1886–'87 it was found only on a few plants growing along the shady bank of a stream. It has not been common the last season and is peculiar in only attacking here and there a whole plant.

PERONOSPORA EFFUSA, RABH., is a common species upon *Chenopodium album*, but was far less abundant than usual during the two dry seasons.

PERONOSPORA POLYGONI, THÜM., is rare on *Polygonum dumetorum.* Mr. Hitchcock found the mildew upon *P. aviculare*, at Iowa City in May of 1887, but it was not at all common. It was abundant upon *P. convolvulus* in July of the last season.

PERONOSPORA ALTA, FCKL., has been almost entirely absent from *Plantago major*, for the last three years. In 1885 it was one of the easiest of the Peronosporas to obtain in quantity.

PERONOSPORA TRIFOLIORUM, DBY., has heretofore been one of our most common species upon *Astragalus Canadensis*, and especially on *Vicia Americana.* Upon the latter two years ago it was so abundant as to almost destroy the host in whole patches. It was found in 1887 only after diligent search in the moistest places where the vetch will grow. It again appeared in 1888 but in milder form than before the dry years.

PERONOSPORA EUPHORBIÆ, FCKL., is a species which quickly disappears in times of drought. It is not uncommon on *Euphorbia maculata*, in a wet season, but rare indeed in 1887. The usual amount was met with in 1888 noticeably dwarfing the small leaves of the host.

PERONOSPORA LEPTOSPERMA, DBY., was common in 1885 on both *Artemisia biennis* and *A. Ludoviciana.* During 1887 it was met with in only a few places on *A. biennis*, growing in moist spots near excavations along a railroad track. Last season found it abundant again.

PERONOSPORA SORDIDA, BERK., is a good illustration of the influence of moisture upon the development of *Peronosporeæ.* The host *Scrophularia nodosa* is a common plant on the banks of streams, especially where the surface is without sod. In 1887 the mildew was abundant in only one place—a bend of a stream where the host grew close to the water and could obtain moisture freely. It was not at all uncommon during the last growing season.

PERONOSPORA LOPHANTHI, FARLOW, on *Lophanthus scrophulariæfolius*, is a rare species in Iowa and was met with only in 1887.

PERONOSPORA GRAMINICOLA, SCHRŒT., which was abundant in 1886 upon *Setaria viridis*, transforming the inflorescence of the grass into strange shapes, was far less common during 1887. Last autumn it infested the foxtail quite generally and appeared to some extent upon the Hungarian grass. This new parasite may do much mischief in the future.

PERONOSPORA CALOTHECA, DBY., is not rare upon species of *Galium.* In October, 1887, seedling plants, which had come up in a rich mold since the September rains, were badly infested. This is a good illustration of fresh, growing tissue being favorable for the development of *Peronosporeæ.*

The genus *Cystopus* has four species common to Iowa.

CYSTOPUS CANDIDUS, LÉV., like *Peronospora parasitica*, is confined to the *Cruciferæ*, and also like it lives over the winter within the tissue of the seedling plants. There was an abundance of the *Cystopus* on Shepherd's-purse seedlings in the spring of 1887, and it produced a large crop of spores which did not spread the trouble rapidly to other plants as in an ordinary season. In June there was very little of the mildew and only a few spots could be seen on the seedlings in the autumn. Only a small amount of the fungus was found the next spring. The mildew was fairly abundant upon the common pepper grass (*Lepidium Virginicum*), but soon disappeared. Three years ago in a moist season the blossoms, flower stalks, and seed vessels of the garden radish were generally attacked and often distorted beyond recognition. Very late in October, 1887, the mildew was found prevalent upon seedling plants of *Sisymbrium officinale*, which had developed after the September rains in a shady place. Last year there was very little of the mildew upon the Shepherd's-purse. The two dry years had done much toward eradicating it along with the host.

CYSTOPUS CUBICUS, LÉV., is the least common species of the genus, and for the last three years has been found upon *Ambrosia artemisiæfolia, C.*, only at rare intervals.

CYSTOPUS BLITI, LÉV., occurs upon an increasing list of hosts. *Amarantus blitoides*, was badly infested in all three seasons, and as this species flourishes in dry places, upon paths, and roadways it at first seems an exception to the rule. However, this Amaranth is thick-leaved and succulent, and like the purslane is full of moisture, even though the surroundings are arid. It was a fact of observation that the greatest development of the mildew was upon plants which were most favored with moisture and shade.

CYSTOPUS PORTULACÆ, LÉV., is the last species of the list and one of no little interest in the present connection. It seems to have been more abundant during the two dry seasons than before or since. The host is a juicy plant and the appearance of greater thrift on the part of the parasite may be due to the fact that it was more than usually destructive, the purslane not being able to withstand its attacks. Therefore a patch of the host while showing more of destructive effects of the mildew might in fact have less of the parasite. It is impossible to say there was more or less of the mildew the last year than the season preceding. These observed facts seem to show that with the *Peronosporeæ* there is no doubt that the species are best suited to a moist season. The members of the genus *Peronospora* have in no instance been so abundant during the two dry years as before or since the drought. In general the mildews were found in early spring in 1887, after this, through the long dry summer, in limited quantities, upon plants growing in moist places along streams and edges of pools. In 1888 the greatest abundance was in June after the May rains.

The genus *Cystopus* seems less influenced by drought, but as a rule the infected specimens were those best situated for obtaining moisture. In all cases where *Peronosporeæ* flourished in drought, they were upon succulent hosts, and even with these there was probably less growth of parasite but a greater manifestation of disease due to lack of vitality in the hosts. These instances, therefore, form no exception to the general rule, that dry weather is not advantageous for the development of the *Peronosporeæ.*

In preparing this paper the writer has drawn freely upon his article "Downy Mildews in a dry Season" in Ames' (Iowa) College Bulletin, 1888, which gives an account for the years 1886 and 1887, and in some instances the form of statement therein used is here reproduced.

AN INTERESTING UROMYCES.

By BYRON D. HALSTED.*

The following description is of a *Uromyces* collected the past autumn, which has the habit of infesting the perigynia of a sedge, causing them to assume a quite unnatural dark color before their time of maturing.

UROMYCES PERIGYNIUS, HALSTED. Sori one-half to 2^{mm} in diameter, forming dark-brown, nearly globular patches upon the outside and between the veins of the perigynia, not infrequently upon both surfaces of the younger leaves, where the patches are often three times as long as broad. Teleutospores somewhat variable, 4–6 by 8–10μ, with a prominent brown free end ranging from acute to wedge shaped. Contents usually granular and often with a large oil globule. Pedicel two to three times the length of the spore, slender and hyaline.

On *Carex intumescens*, near Ames, Iowa, September, 1888. D. G. Fairchild.

The other known species of *Uromyces* upon *Carex* is *U. Caricis* of Peck (Mycotheca Universalis No. 746), which is very different in habit and characteristics of the spore. It is reported only upon *Carex stricta* and not upon the perigynia. In making the comparison it was interesting to observe that with *U. Caricis, Pk.*, there were ocasional double spores among those of normal form. Sometimes a half dozen adjoining spores in a partially crushed sorus would be of the puccinia type. Those who are subscribers to Ellis and Everhart's N. A. F. may expect the *Uromyces* above described in the next issue.

NEW SPECIES OF KANSAS FUNGI.

By W. A. KELLERMAN and W. T. SWINGLE.

TILLETIA BUCHLOËANA *n. s.* In the much enlarged and mostly globular ovaries of *Buchloë dactyloides*, abnormally borne on the male plants; often all or nearly all the staminate spikelets produce the ovaries, all of which are infested. Spores dirty brown in mass, as seen

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